

## FEEDBACK-PROVIDING KEYPAD FOR TOUCHSCREEN DEVICES

### CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not applicable.

### STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

### BACKGROUND

[0003] The present invention relates generally to the field of mobile devices, and more particularly to mobile devices that can manipulate content being presented on a user-interface (UI) display via activated user-input elements.

[0004] Mobile devices, including personal digital assistants (PDAs), handsets, and other computing devices, often rely on keys located on the surface of the device (e.g., miniaturized alphanumeric, "QWERTY" keyboard) to receive user-initiated inputs. Typically an input, such as entering text, is made by selecting a single-purpose key on the keyboard that is effective for a specific operation, regardless of the application being presently implemented. Because these keys cannot adapt to an application that is currently running (e.g., dialing versus text entry), an appropriate surface area must be designated on a mobile device to house a full keyboard to accommodate inputs for various applications. Thus, these mobile devices with full keyboards consume an exorbitant spatial area that is not practical in the compact mobile environment and create a disconnect between a key layout of the mobile device and the functionality of a running application.

[0005] Some mobile devices, with larger display areas, employ a touchscreen for offering onscreen keyboards that accept user-initiated inputs at keys presented therein. These keys may adapt to the application being performed by the mobile device. But, these onscreen keys are nondistinct from the remainder of the screen and lack the texture and feel (e.g., tactile feedback) of actual keys. This deficiency generally results in reduced speed and accuracy when inputting information at the screen. Accordingly, employing an onscreen set of actual keys that can adapt to a variety of applications, and can be continually updated, would provide a robust method of facilitating user control over the functionality of a plurality of applications and enhance a user's computing experience when using a touchscreen-enabled computing device.

### SUMMARY

[0006] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter nor is it intended to be used as an aid in determining the scope of the claimed subject matter. The present invention is defined by the claims.

[0007] Embodiments of the invention have several practical applications in the technical arts, including providing a touchscreen device (e.g., mobile handset, flat-panel monitor) having flexible touchpad and user-input elements to manipulate the flexible touchpad to create a physically-extending keypad thereon. The physically-extending keypad (e.g., touch-sensitive keys) facilitates, among other things, user control over an application presently running on the touchscreen device. Initially,

a request is received at the touchscreen device that may include presentation data and/or configuration settings. The request may be detected from operations performed by an application running on the touchscreen device, initiated by a user entering an input at the touchscreen device, or provided by any other method for generating an indication to execute a particular function. Upon receipt, the touchscreen device conveys the presentation data to the flexible touchpad that presents content (e.g., alphanumeric characters) at a user interface (UI) display in accordance with the presentation data. The configuration settings are accessed from the request and conveyed to an electromechanical device that manipulates a portion of the user-input elements (e.g., set of moveable pins) to extend, thereby expressing at the flexible touchpad a physically-extending keypad consistent with the request. In an exemplary embodiment, the user-input elements in the extended orientation are set to an active condition such that user-initiated actuation thereof generates an input signal. In addition, outwardly-extending protrusions of one or more of the user-input elements in the extended orientation may be positioned proximately to alphanumeric characters presented on the UI display, thereby indicating the type of input assigned to the outwardly-extending protrusions comprising the physically-extending keypad. As such, the appearance and tactile feedback provided by an actual keyboard, dial pad, and the like, may be replicated by the physically-extending keypad expressed at the flexible touchpad, which is adaptable based on the received request.

[0008] Embodiments generally relate to one or more computer-readable media having computer-executable instructions embodied thereon that, when executed, perform a method for manipulating a set of moveable pins to produce a physically-extending keypad (e.g., alphanumeric pattern of outwardly-extending protrusions expressed at the flexible touchpad). More particularly, a first aspect of an embodiment is directed to a processing unit of the touchscreen device for receiving an application-generated, or user-initiated, request. Initially, a determination of whether manipulating the physically-extending keypad is appropriate to address the request is performed. In one instance, determining includes identifying whether the request is associated with a predefined configuration of the set of moveable pins, where the predefined configuration specifies the portion of the set of moveable pins to adjust to the extended orientation and which of the set of moveable pins to set to an active condition. If appropriate, an indication to activate an electromechanical device to adjust a portion of the set of moveable pins to an extended orientation is provided. Typically, the portion of the set of moveable pins in the extended orientation influences an appearance of a flexible touchpad incorporated within the touchscreen device. Accordingly, when in the extended orientation, the portion of the set of moveable pins produces the physically-extending keypad consistent with the request.

[0009] A second aspect of an embodiment takes the form of a touchscreen device for manipulating one or more user-input elements according to configuration settings. Generally, the touchscreen device includes a processing unit, an electromechanical device, the one or more user-input elements, and a flexible touchpad. Initially, the processing unit communicates presentation data to the flexible touchpad and executes a manipulation procedure. The manipulation procedure, in one instance, includes the following: receiving one or more requests; and accessing configuration settings based on processing the one or more requests. The electromechanical